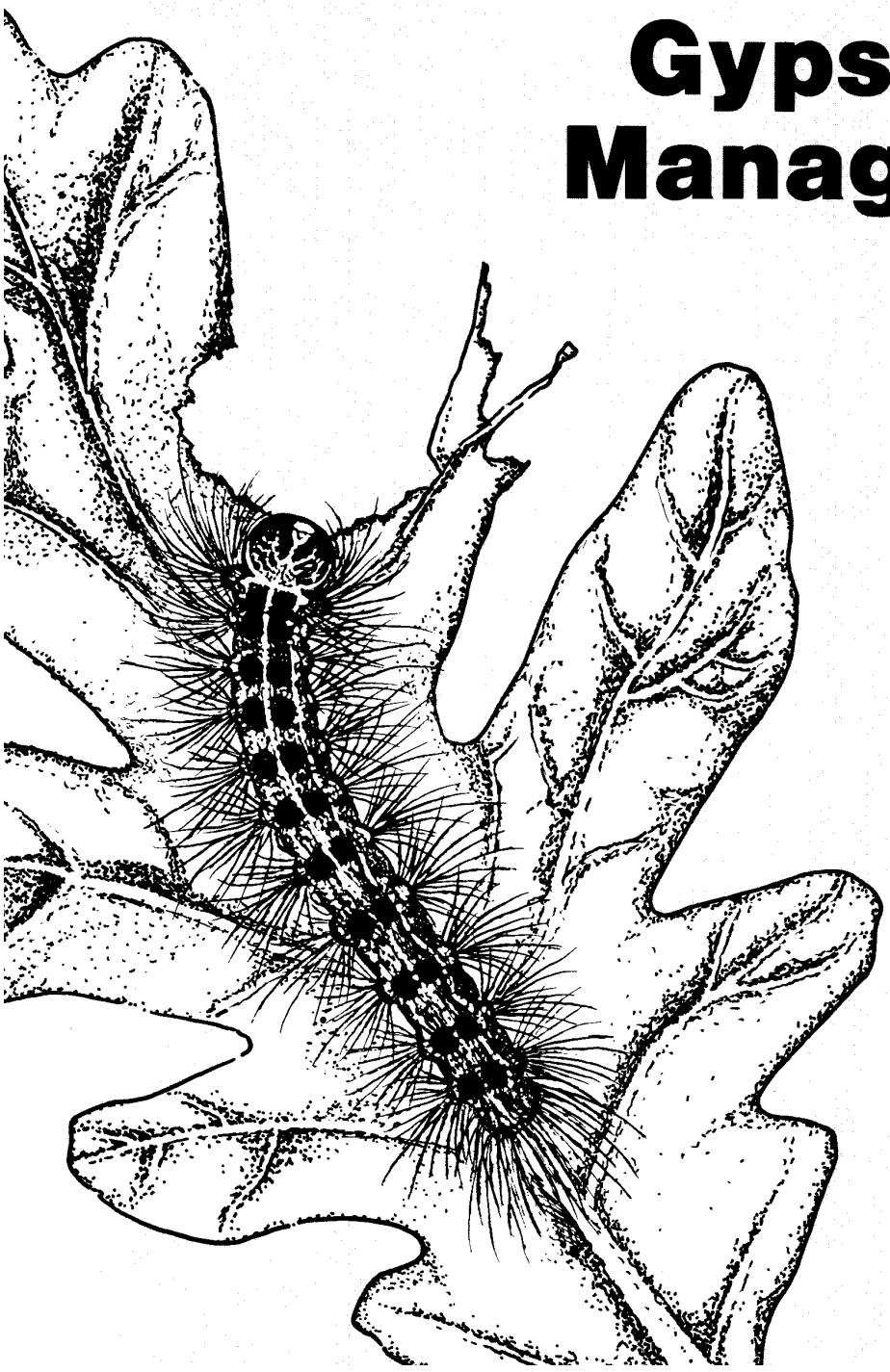
West Virginia University
Extension Service

Homeowner's Guide to Gypsy Moth Management



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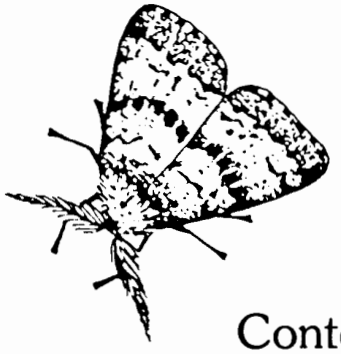
Acknowledgments

The authors wish to thank the following for their review of the manuscript: Dr. Richard Reardon, research entomologist, Forest Service, U.S. Department of Agriculture; David Workman, Hardy County agent, WVU Extension Service; Suzanne M. Poland, assistant specialist—integrated pest management, WVU Extension Service; and Dr. Peggy K. Powell, assistant specialist—pesticide impact, WVU Extension Service.

Appreciation also is expressed to Joyce A. Bower, assistant specialist-publications, for manuscript editing; and to Sheila Gairhan, graphic arts designer, for design and layout of this publication. Both are with the Information and Educational Technology Unit of the WVU Extension Service. Emily Grafton is assistant specialist—gypsy moth, WVU Extension Service. Dr. Ralph Webb is research scientist, Agricultural Research Service, U.S. Department of Agriculture.



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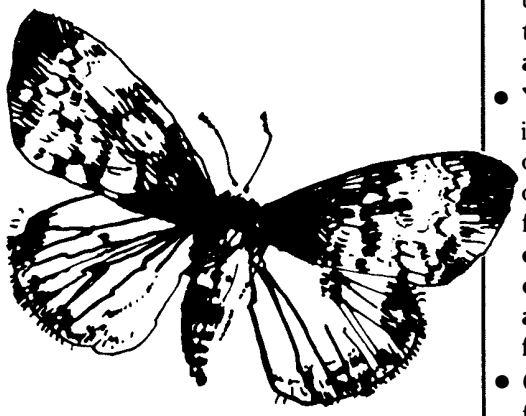
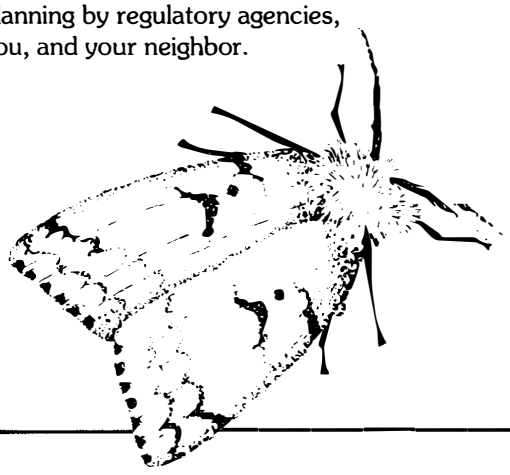
Facts You Need to Know About Gypsy Moth

The gypsy moth has been considered an introduced forest insect pest for the past 120 years. Introduced from France, it was accidentally released into Medford, Massachusetts, around 1869. Since then, it has gradually trailed the spine of the Appalachian Mountains into West Virginia.

It has now become a permanent resident of the northeastern United States. Several of West Virginia's Eastern Panhandle counties also have become permanently infested. The insect is continuing to radiate south and west from this area and appears sporadically in isolated spots throughout the state.

The gypsy moth caterpillar has a very big appetite, and is capable of feeding on some 500 species of trees and shrubs. Unfortunately, the leaves of most oak species are its preferred food. In fact, an area must have a reasonable amount of oak trees for gypsy moth populations to build up. Nearly 80% of West Virginia's forests are very heavily stocked with oak. However, scientists cannot always predict with accuracy where and when populations will expand or exactly how this insect will affect your trees and you. This translates into the need for close monitoring and planning by regulatory agencies, you, and your neighbor.





- Gypsy moth can be destructive to trees and shrubs, creating environmental and financial burdens to homeowners! **Learn to identify this insect pest and all its life stages!**
- You could accidently bring this insect pest onto your property on vehicles, camping and other outdoor equipment, boats, firewood, etc. **Inspect vehicles, outdoor equipment (tents, campers, etc.) after traveling and firewood before stacking for egg masses and pupae.**
- Gypsy moth can multiply from a few hundred caterpillars to destructive levels in one or two years. **Place burlap and sticky bands on susceptible trees for early detection of all life stages.**
- There are no quick fixes that will get rid of gypsy moth once it has become established. **A combination of biological, mechanical, and/or chemical strategies works best!**
- In the early stages of population density increase, the egg mass is more likely to be found on rocks, manmade objects, or other places near the ground. **Keep your lawn and woodlot clean and free of hiding places (woodpiles; trash; old, unused equipment) for egg mass and pupae. Inspect outbuildings, woodpiles, fences, and rock gardens, as well as trees and shrubs.**

How to Know the Gypsy Moth

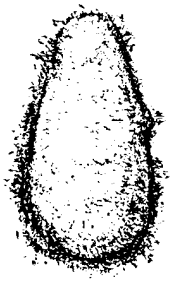
The figures on the right illustrate the four life stages of the insect: egg, larva (caterpillar), pupa, and adult. The caterpillar stage is the one which does the damage. After hatching, the caterpillars may feed for up to two months on the leaves of trees before entering the resting or pupal stage.

The caterpillars begin to emerge by mid-April. The newly hatched larvae are all black with tufts of billowy hairs. As a caterpillar matures, distinctive markings develop, five double rows of blue spots and six double rows of red. The tufts of long hairs are prominent throughout its development. The feeding and resting behavior of the caterpillar changes significantly at different stages of its growth. *The key to minimizing gypsy moth impacts is applying the appropriate management strategy to specific stages or sizes of caterpillars throughout their development.*

The pupal stage lasts for only about two weeks. The reddish brown pupae also have a few scattered tufts of hairs. The pupa varies from ½ to 1 inch in length.

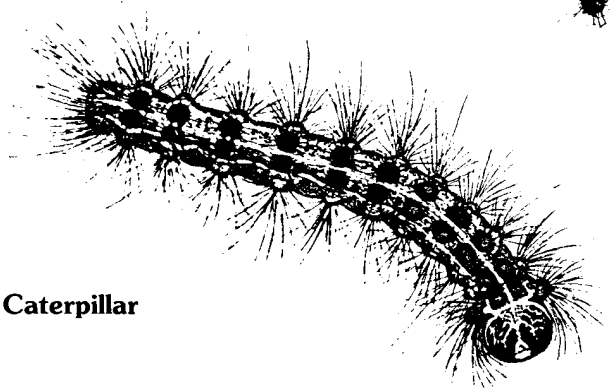
The moth or adult stage is of shortest duration—about one week. The male is charcoal gray with brown wavy markings; it emerges first. The female is larger, cream colored with black wavy markings. Upon hatching the female begins emitting a "scent trail" called a pheromone. This draws the male to her to fertilize her eggs. The female does not fly.

Once she is fertilized, the female will lay several hundred eggs in one egg mass. The egg mass is a creamy beige color and appears velvety. The egg mass is approximately 1-½ inches long by ¾-inch wide; it resembles a small piece of a camel hair sweater. When doing a survey, it is important to distinguish between new and old egg masses. They are most easily distinguished by the way they feel to the touch. Old egg masses feel soft and spongy, whereas new egg masses feel hard and firm.



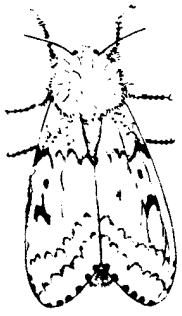
Egg Mass

Ballooning Young Caterpillar (enlarged about 7x)



Mature Caterpillar

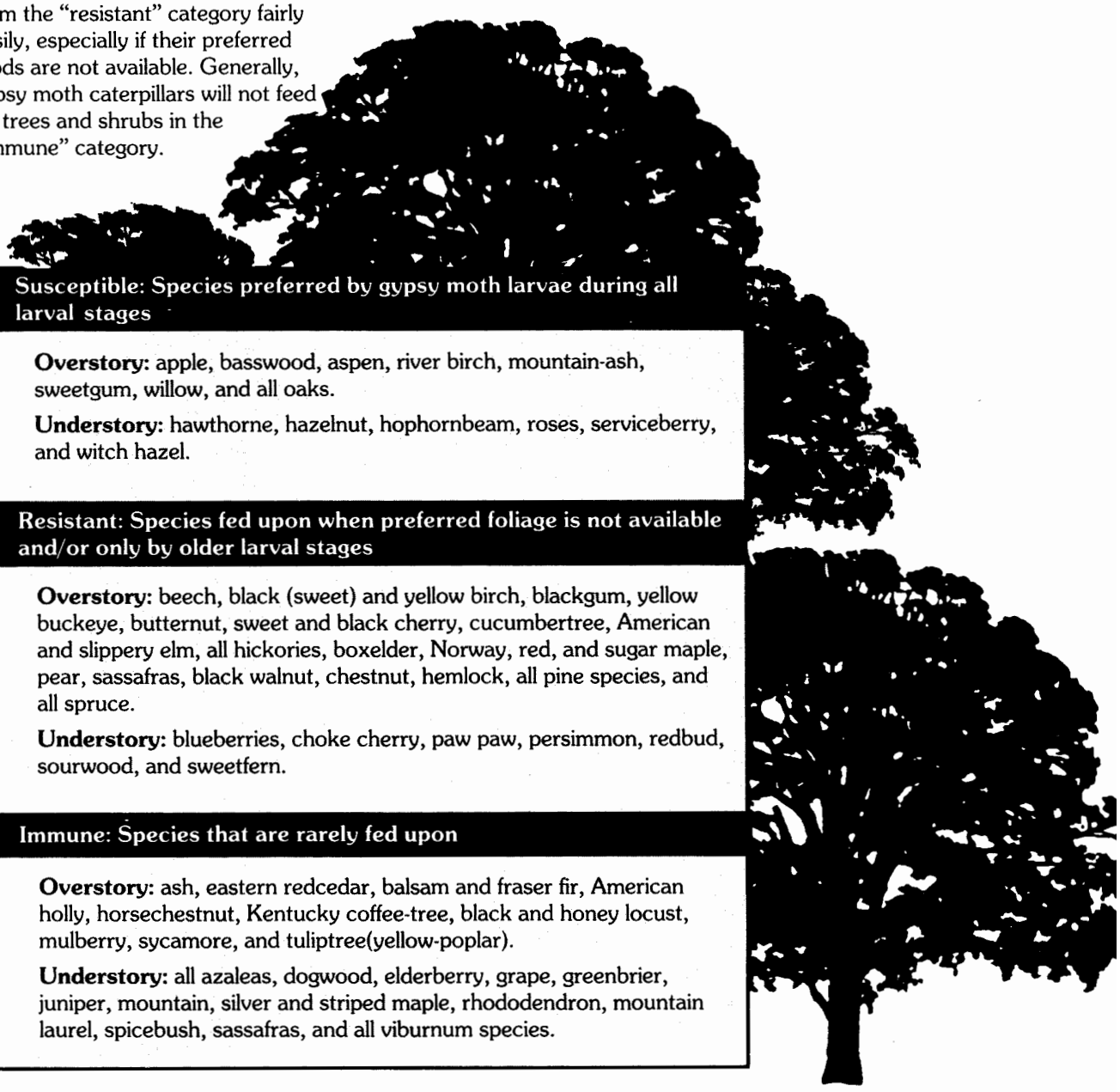
Pupa



Adult Female

Gypsy Moth Feeding Habits

Tree species listed under the "susceptible" category are eaten by the gypsy moth caterpillar from hatch to maturity. These are the species most preferred. The caterpillars must have trees from this list in order to thrive. As caterpillars mature they can expand their diet. From the third instar to maturity, they will consume leaves from the "resistant" category fairly easily, especially if their preferred foods are not available. Generally, gypsy moth caterpillars will not feed on trees and shrubs in the "immune" category.



Susceptible: Species preferred by gypsy moth larvae during all larval stages

Overstory: apple, basswood, aspen, river birch, mountain-ash, sweetgum, willow, and all oaks.

Understory: hawthorne, hazelnut, hophornbeam, roses, serviceberry, and witch hazel.

Resistant: Species fed upon when preferred foliage is not available and/or only by older larval stages

Overstory: beech, black (sweet) and yellow birch, blackgum, yellow buckeye, butternut, sweet and black cherry, cucumbertree, American and slippery elm, all hickories, boxelder, Norway, red, and sugar maple, pear, sassafras, black walnut, chestnut, hemlock, all pine species, and all spruce.

Understory: blueberries, choke cherry, paw paw, persimmon, redbud, sourwood, and sweetfern.

Immune: Species that are rarely fed upon

Overstory: ash, eastern redcedar, balsam and fraser fir, American holly, horsechestnut, Kentucky coffee-tree, black and honey locust, mulberry, sycamore, and tuliptree(yellow-poplar).

Understory: all azaleas, dogwood, elderberry, grape, greenbrier, juniper, mountain, silver and striped maple, rhododendron, mountain laurel, spicebush, sassafras, and all viburnum species.

Sound Gypsy Moth Management Is Spelled IPM

What Is IPM and How Does It Apply to Gypsy Moth?

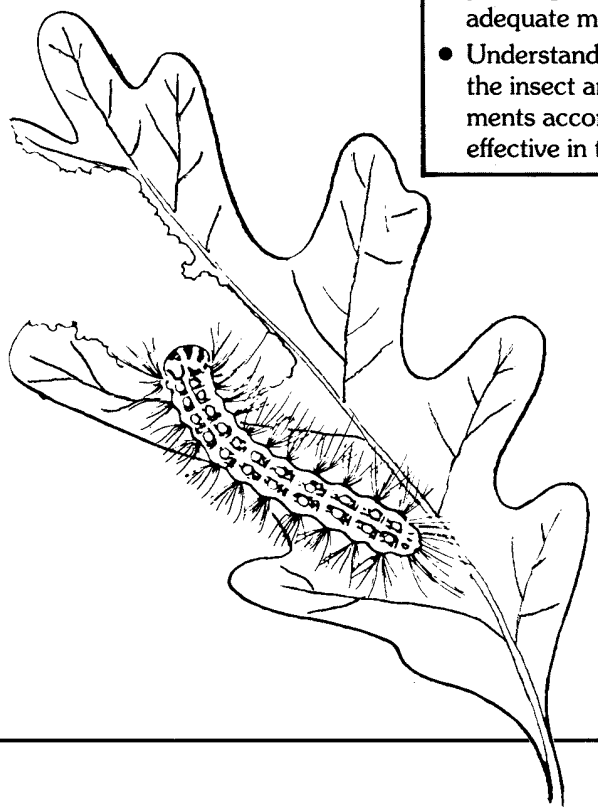
Integrated pest management (IPM) is the systematic management of insect pest populations. It is based on the close monitoring of insect conditions and the use of control measures wherever and whenever necessary. Control measures are chosen according to established population thresholds (number of egg masses per acre for gypsy moth). Put simply, certain control measures may be applied when the populations are low, and other control measures are applied when the populations are high. An IPM program does not rely on, or exclude any particular type of management strategy. Biological, cultural, mechanical, and chemical control tactics are all considered.

IPM encourages the use of control tactics that permit natural control agents to have maximum impact and that have minimum effect on nontarget organisms in the environment, including humans. If several potential control tactics are available, the choice of method will reflect the management objectives and control philosophy of the user. Tolerance to the presence of insect pests varies among individuals. Also, what one person considers an acceptable environmental risk, another may not.

Components of an IPM system are (1) survey, (2) problem delineation and selection of control methods, (3) application, and (4) evaluation. Well-defined surveys, thresholds, and statistically based gypsy moth IPM programs have not been developed for homeowners or organized communities. The statistically based survey technology developed for use in the general forest is not directly applicable to nonforest areas. However, some general guidlines are being recommended.

Why Follow an IPM Program?

- Automatically and routinely applying pesticides can be counterproductive, economically wasteful, and environmentally unsound.
- Gypsy moth is here to stay. Consequently, we must learn to "live with" or manage gypsy moth by attempting to minimize its impacts.
- It is not necessary to eliminate the insect, or to prevent defoliation completely in order to adequately protect your trees.
- Gypsy moth is an unpredictable insect pest in terms of knowing when and where populations will increase. There is no guaranteed formula to follow; consequently, constant monitoring and planning are necessary for adequate management.
- Understanding the life cycle of the insect and applying treatments accordingly may be more effective in the long run.

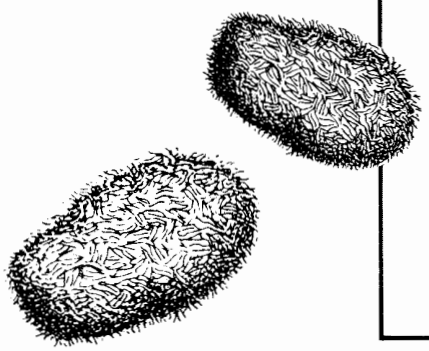


An IPM Method for the Homeowner

The following is a common sense IPM program for homeowners based on the field experience of scientists with the Agricultural Research Service, U.S. Department of Agriculture.

How to Survey Your Property

You should survey your property and the area immediately around you for egg masses in the fall (September or October) while the weather is nice. This will allow sufficient time to plan your program for the spring and to make necessary arrangements. Be sure to distinguish between old and new egg masses and count only new egg masses (see descriptions, page 2). Generally, if your gypsy moth population is new to the area or is rising, you can consider all your egg masses as "new." If your gypsy moth problem was bad last year, touch a number of accessible egg masses, determine the percentage of new to old, and adjust your visual counts accordingly. See page 2 for description of old egg masses.



Step 1: Determine the susceptibility and vulnerability of your trees and which situation describes your property.

Survey your stand for the presence of trees most preferred by gypsy moth and for the presence of older, more vulnerable species. Refer to "Gypsy Moth Feeding Habits" on page 3.

Situation 1: You have a large lot with numerous oaks.

Situation 2: You have one-to-several oaks, but these are all the trees you have, or are large-specimen trees.

Situation 3: You have one-to-several oaks, but most of your trees are less preferred.

Situation 4: You have no oaks, or other highly susceptible trees; you probably will never have a gypsy moth problem.

My property comes under situation number _____ .

Step 2: Consider the isolation of your stand:

Situation A: Your trees are part of an extended "urban forest."

Situation B: You are part of a larger community with scattered trees, generally less than five trees per acre.

Situation C: Your trees are essentially isolated.

My property fits situation letter _____ .

Step 3: Conduct your survey: Determine your classification, (are you a 3C, or 2B, etc.). Then, perform the following procedures according to your classification.

Isolated Situations: (3C, 2C, 3B, 3A)—Count all new egg masses on your susceptible trees, and calculate the average number per tree.

Example 1: You have 5 oak trees.

Tree	Egg Mass #	Average per Tree
A	7	Divide the total number
B	3	of egg masses by the
C	1	total number of trees.
D	1	Twelve divided by 5 gives
E	0	a value of 2.4.
	12	

Nonisolated Situations (2A, 1A, 1B) You need to consider what is happening in your immediate neighborhood as well as your own property.

Step 1. Mentally draw a 600-foot circle (2 football fields end to end) around the center of your property.

Step 2. You should record on the paper the number of egg masses that you can count on each of 50 susceptible (oak) trees within your mental circle. If no egg masses are seen on a tree after a 1-minute scan, record a zero and move on (use 2 minutes for large trees).

Step 3. Trees should be at least 6 inches in diameter. Start counting egg masses at the bottoms of the trees, where they are easiest to see.

Step 4. You can stop counting when you reach 10 egg masses on a particular tree, and mark 10+ on your paper.

Step 5. At the end of the survey, score your trees as follows: each tree with no egg mass = 0; each tree with 1-2 egg masses = 1; each tree with 3-9 egg masses = 2; and each tree with 10+ egg masses = 3. Calculate your score.

Example 2: Of your 50 trees, 29 have a score of 0; 15 have a score of 1; and 6 have a score of 2. (0x29)+(1x15)+(2x6) = 15+12 = 27. This is a relatively low score and indicates that the gypsy moth is a potential problem, but defoliation is not expected to be severe this year.

Example 3: Of your 50 trees, 7 have a score of 1, 15 have a score of 2, and 28 have a score of 3. (7x1)+(15x2)+(28x3) = 7+30+84 = 121, a relatively high score, indicating a threat of moderate to severe defoliation if no action is taken.

Problem Delineation and Treatment Options

The action thresholds and treatment options listed at right are suggested on the premise that the above survey has characterized your local population, and that this local population develops "normally," with the proviso that gypsy moth populations can balloon in from neighboring properties or can collapse without warning.

Evaluation

Keep track of any defoliation occurring to your trees. Do a postseason egg mass survey in the fall. Were your objectives achieved? If not, you may wish to institute an improved control strategy next year, if your survey suggests a continuing problem. The cheapest and most effective method of gypsy moth control is a communitywide aerial spray program.

Isolated Situations (3C, 2C, 3B, 3A)

Number of egg masses per tree	*Predicted Defoliation*	*Suggested Treatment*
0	None	None
Less than 1	None	Burlap bands for late-season monitoring and destruction of life stages.
1-10	Under 30%	Sticky barrier bands.
10+	30% or more	Sticky barrier bands; pesticide treatments; should be considered, consult county extension agent or commercial arborist.

Nonisolated Situations (2A, 1A, 1B)

Score	*Predicted Defoliation*	*Suggested Treatment*
0	None	None
1-10	None	Burlap trees near house; monitor the late-season population; and destroy any life stages found.
11-50	Trace	Problem a year away; carefully monitor as above.
51-100	about 30%	Notify neighbors and authorities; consider communitywide aerial application of pesticides.
101+	30% or more	As above, plus sticky barrier bands for specimen trees and trees around house.

Control Methods

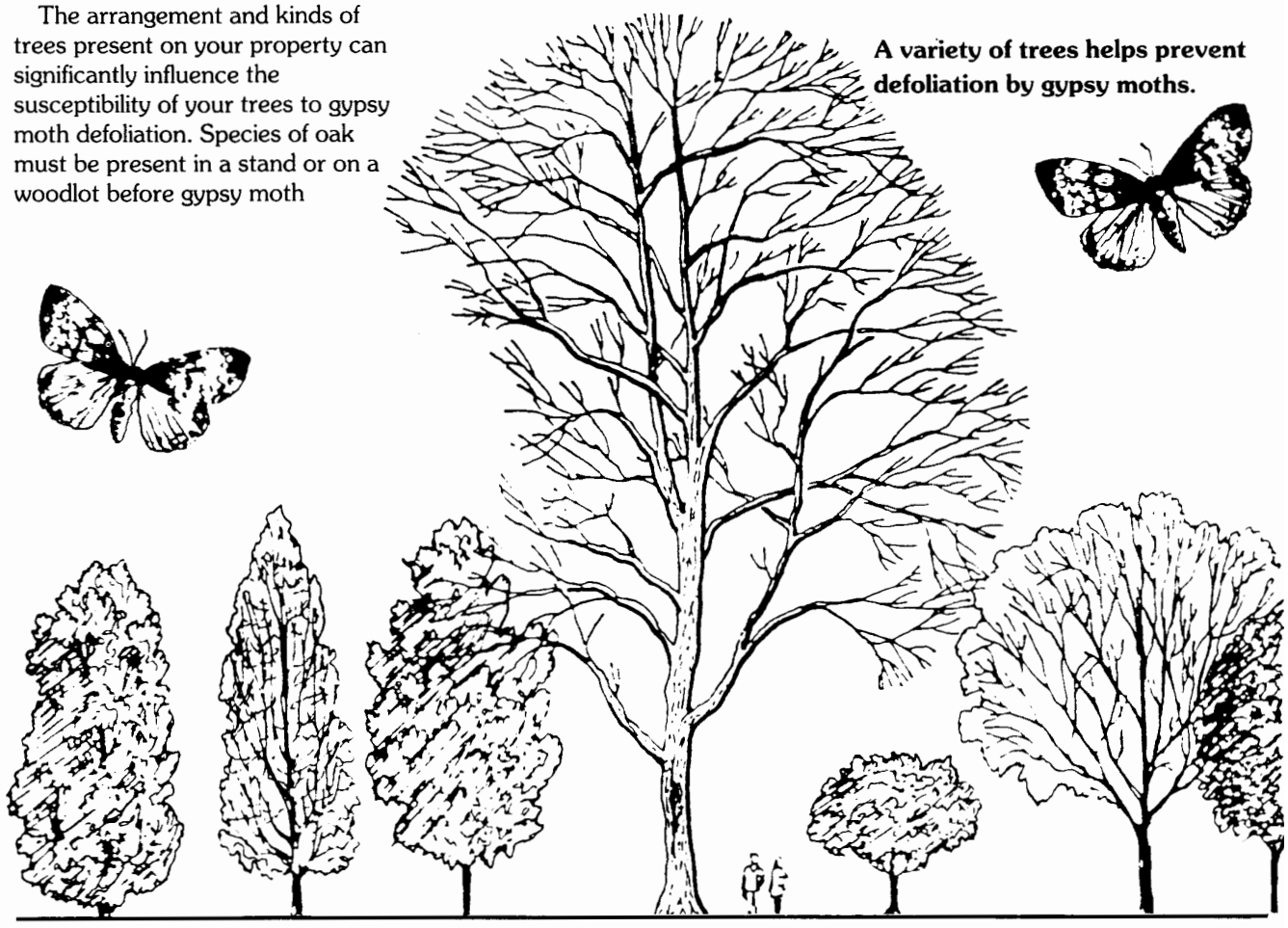
Cultural Controls

Cultural strategies include tactics that make the habitat less suitable for the insect pest. The term "habitat manipulation" is often used to describe the strategies. Many of them can be considered preventive measures. The list includes: (a) planting resistant species, (b) improving tree health (fertilizing, mulching, watering, and pruning all dead limbs), and (c) removing gypsy moth hiding and egg-laying sites.

Planting Resistant Species

The arrangement and kinds of trees present on your property can significantly influence the susceptibility of your trees to gypsy moth defoliation. Species of oak must be present in a stand or on a woodlot before gypsy moth populations will expand to any significant level. However, if your property is adjacent to a well-stocked oak stand, your trees may be impacted even if they are in the group of moderately preferred (resistant) species.

Having a well-dispersed mixture of preferred and nonpreferred species can reduce the impact of gypsy moth. See Feeding Habits Chart on page 3. Ideally, if all the trees on your property consisted of species listed in the "Immune" category, you would not have to worry about gypsy moth. Although you may not wish to limit the plantings on your woodlot or lawn to these species, you may consider adding some of them to the plantings you already have. Tree and shrub species especially safe include: walnut, ash, tulip popular, locust, sycamore, American holly, all azaleas, dogwood, juniper, mountain, silver, and striped maples, rhododendron, and all viburnum species. Refer to the chart for a complete list.



A variety of trees helps prevent defoliation by gypsy moths.

Improving Tree Health

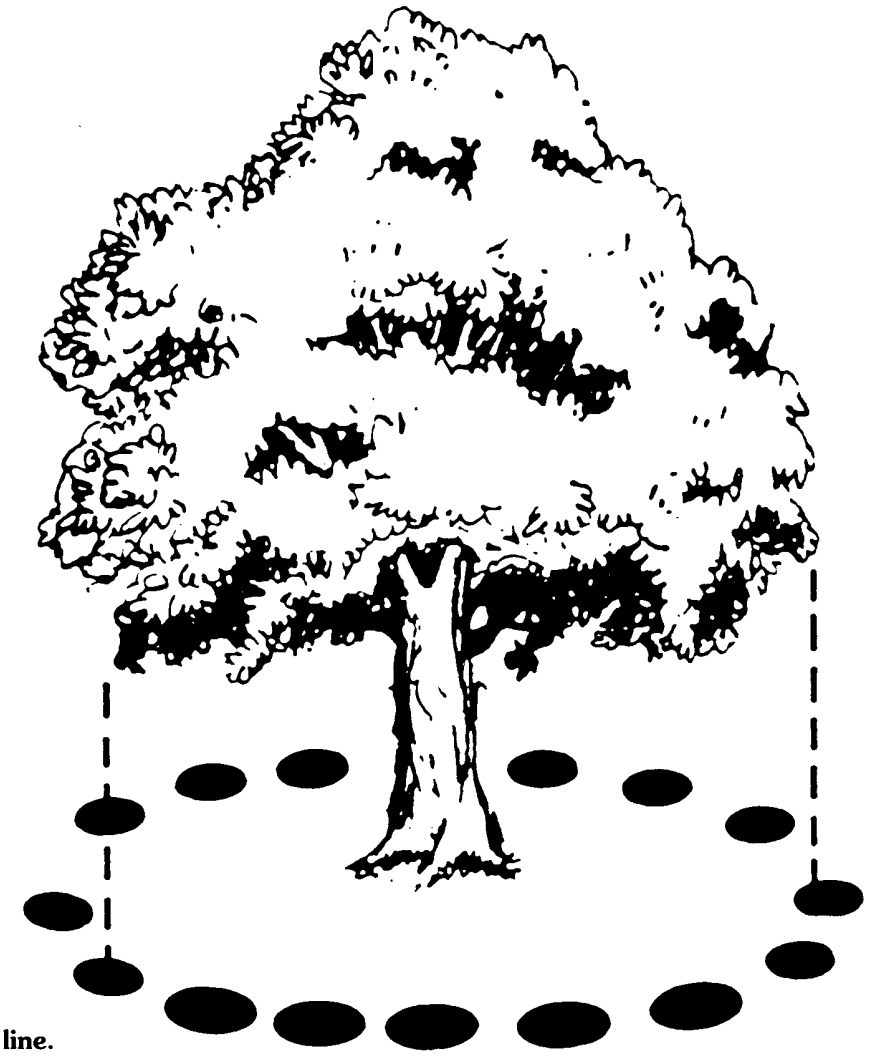
Fertilizing and watering trees, as well as pruning all dead limbs from them, are very important strategies for safeguarding your trees. Many research studies have demonstrated that tree health is the single best indicator for tree survival. Generally, very healthy trees can sustain one to three repeated defoliations with minimal damage. However, even the healthiest trees may sometimes succumb to repeated defoliations as a result of extremely severe droughts and/or severe winters.

Maintain good soil nutrient and moisture levels with regular applications of fertilizers and consistent watering. Fertilizers can be applied on a relatively regular basis, every spring and fall. How much water to apply will vary with seasonal fluctuations in rainfall. Keep a ring of mulch around shade trees; this will significantly aid in water retention. Maintain as much natural leaf litter as possible on your lot. During extreme periods of drought pruning to remove excess branches can aid in water retention and conservation.

Older trees are more vulnerable. Some of our most valuable tees are those large, old oaks and maples which provide ample shade and other aesthetic values for homes and lawns. These trees are unfortunately very vulnerable to even moderate defoliation levels. Protect older specimen shade trees quite diligently.

Removing Gypsy Moth Egg-Laying and Hiding Sites

Creating a less favorable habitat for gypsy moth egg laying can help. Remove all unnecessary yard objects: piles of old wood, and other building materials; dead branches; firewood, and other refuse. Use up your winter supply of firewood, and do not stack a new supply until necessary. Remove any hiding places on the trees themselves: ivy, bark flaps, and dead branches.



Fertilize trees in holes at the drip line.

Mechanical Controls

Many of the mechanical management controls used today were initiated when the first major outbreaks occurred from 1889-1899 in Medford, Massachusetts. Some of these control measures or tactics have been improved over the years. They can be useful tools for gypsy moth management; however, they will not eliminate populations nor will they prevent major outbreaks.

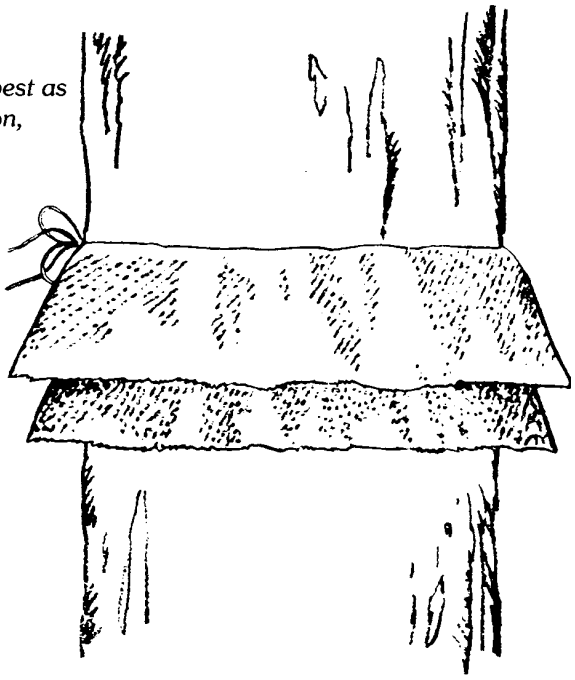
Tree Banding

Burlap Bands—Physically removing late instar caterpillars and pupae from under burlap bands is a time-honored control tactic used by homeowners against gypsy moth. It takes advantage of a quirk in larval behavior in that late instar caterpillars tend to feed at night and rest during the day (this occurs primarily during low or moderate larval densities). The caterpillars descend the trees at dawn in search of a suitable refuge. Burlap bands make an excellent refuge, and descending caterpillars tend to congregate under the bands.

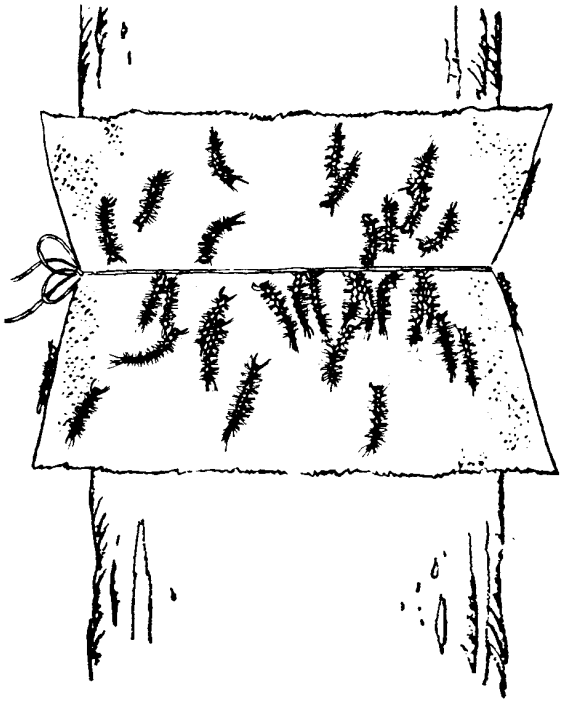
On the other hand, several factors make this an inefficient control strategy:

1. Not all caterpillars will descend even under the best of circumstances.
2. In high-density populations where protection is truly needed, the caterpillars feed day and night, with only a small percentage seeking daytime refuge. Under these conditions there will be constant reinfestation from other trees. Burlap bands will not stop this reinfestation.
3. Tending burlap bands requires sustained effort.
4. Workers are exposed to allergenic hairs.

Burlap bands can serve best as a control in early detection, particularly in areas not previously infested.



Burlap Bands are an excellent refuge for caterpillars.



Barrier Bands—Do barrier bands work? Can they prevent defoliation? Can they reduce populations? Theoretically, barrier bands have been shown to significantly restrict caterpillar movement into the canopy. Research indicates that barrier bands will provide some level of caterpillar reduction and has resulted in substantial foliage protection. However, population reduction, as measured by year-to-year egg mass levels, may not be achieved by banding alone.

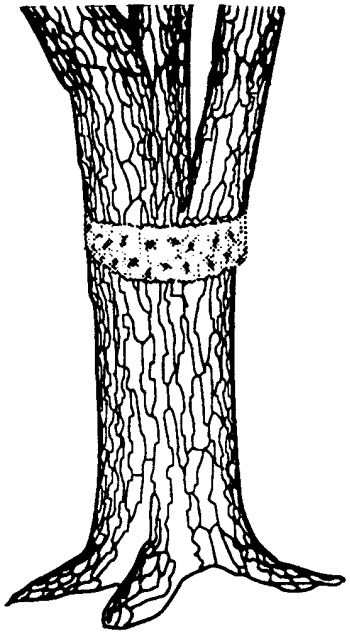
Barrier bands are most effective when put in place before gypsy moth egg hatch. Many newly hatched caterpillars end up on the ground, even if they hatched on the trees. Newly hatched caterpillars crawl to the tips of branches and dangle silken threads into the wind. They frequently are caught by the wind and carried to the ground, another tree, or whatever intercepts their flight. This is called "ballooning," and has been identified as the insect's major method of natural dispersal. If the barriers are in place, they will prevent these caterpillars from reascending.

However, a considerable number of caterpillars may still end up in the tree after hatch. A small percentage of these caterpillars will leave the tree each day; well-maintained barriers will prevent their reascending the tree, and over time, larval reduction will reach the point where defoliation is reduced.

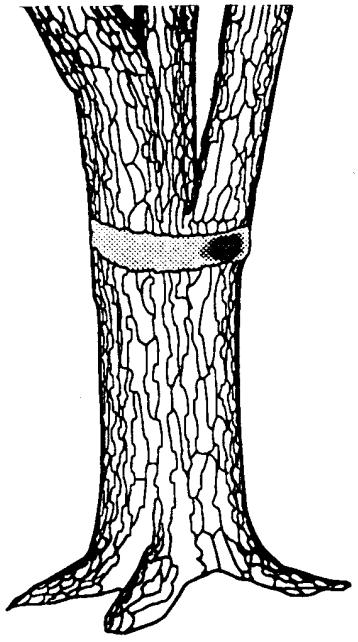
One obvious use for barrier bands is to prevent treated trees from being reinfested. Large numbers of caterpillars will line up below the barrier bands. It is generally useful to destroy these caterpillars (by brushing them into soapy water) to prevent them from moving to shrubs and unbanded trees.

Homeowners can buy prepared bands and follow label instructions, or they can make their own bands. To make a band, wrap a band of duct tape tightly around the tree, sticky side towards the tree. Be sure to tuck the tape tightly into every fissure and crevice in the bark. A few well-placed staples or tacks (you will want to remove these at the end of the season, so nails should be avoided) will keep the bands in place.

Apply the sticky material (Vaseline, Tree Tanglefoot, etc.) to the band; avoid getting this material on the tree bark unless it is known to be safe for the tree. Tree Tanglefoot is safe to apply directly to the bark, but it is difficult to remove, and will discolor the bark. Therefore, Tree Tanglefoot should still be applied to duct tape or some similar band. Smooth-barked trees (red oak) present no problem, but it is difficult to get a good seal on rough-barked (white oak) trees. On rough-barked trees, the Tree Tanglefoot should be applied toward the bottom of the band, lapping over the edge of the band onto the bark at those spots where the band is not flush against the tree. Bands without some sticky material are usually not as effective.



Sticky bands trap the caterpillars.



Slippery bands keep caterpillars from climbing trees.

Removing Egg Masses

The physical destruction of gypsy moth life stages, either by destroying egg mass or by removing caterpillars and pupae from under burlap bands, has been done for many years. However, the usefulness of so doing has been neither demonstrated nor refuted. What will be gained by destroying gypsy moth life stages?

1. Egg mass destruction is mandated by quarantine laws for property being moved from regulated areas to areas free of gypsy moth.
2. Where egg masses encrust street trees in urban areas, newly hatched caterpillars are a health hazard. The hairs of such caterpillars contain histamine and are highly allergenic. Large numbers of such minute, wind-borne caterpillars from egg mass aggregates can lead to epidemics of urticaria, especially in children.
3. Egg mass destruction may be useful in IPM programs.
4. Homeowners who wish to destroy egg masses, for whatever reason, should have safe options.

If the homeowner chooses to physically remove egg masses, the eggs should be destroyed (perhaps by being sealed in a container) rather than just scraped onto the ground. *Eggs on the ground are still viable and in northern areas may actually benefit from the insulating effect of subsequent snow cover.* Scraping egg masses exposes the scraper to allergenic hairs covering the mass, and climbing trees to reach higher egg masses can lead to a dangerous fall. Do not burn the egg masses while they are still on the tree, because this will damage the tree.

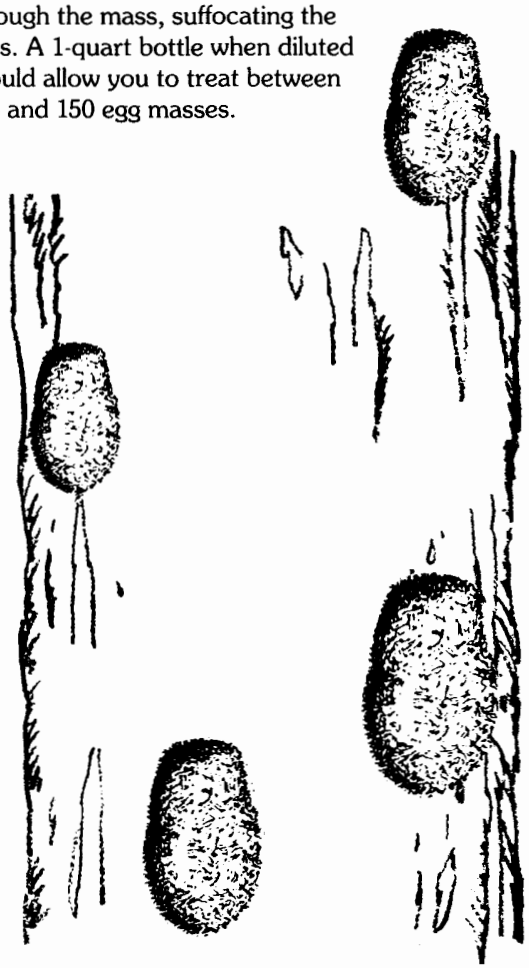
Directly Killing Egg Masses

Application of a 50% solution of soybean oil (50% soybean oil and 50% water) will give excellent control of gypsy moth egg masses. Soybean oil is registered with the U.S. Environmental Protection Agency for this use as Golden Natur'l Spray Oil (Stoller Enterprises, Inc., Houston, TX 77024). Use with a small hand sprayer; treat individual egg masses until they are completely saturated with the spray solution. Keep the mix agitated while using it. Following treatment, egg masses can be left in place or removed and incinerated. Surfactants in the product allow the oil to soak through the mass, suffocating the eggs. A 1-quart bottle when diluted should allow you to treat between 100 and 150 egg masses.

Do Not Buy Into Any Guarantees of Quick Fixes.

Also . . . . . .

- Do not buy pheromone traps for gypsy moth control. They do not work for that purpose.
- Do not buy "bug zappers" for gypsy moth control. The moths do not fly at night.
- Do not place any sticky materials, such as creosote or tar on tree bark. Doing so can injure a tree.
- Do not assume that pesticides will "get rid" of gypsy moth
- Do not assume that finding and destroying a few egg masses cannot make a difference.



Chemical Controls

Using chemical pesticides to reduce defoliation during high population densities is still the least expensive and most effective option. With an IPM approach, the decision to use a pesticide should be based on the results of systematic egg counts. Dealing with an insect pest like gypsy moth involves seriously weighing the risks. The choice of what pesticide to apply and when comes down to a value judgment for each homeowner.

Each individual must assess the risks and benefits of pesticide use. Pesticides are not necessary unless the population thresholds indicate a threat to your trees. However, other factors often are involved. People vary in their tolerance to the presence of caterpillars and even the slightest levels of defoliation. Also, the environmental hazards of pesticides vary from one product to another. Two products may be essentially equal in their effectiveness but one may pose an environmental hazard not acceptable to one person, but irrelevant to another. Therefore, it is important to become informed before making a choice.

At least a dozen pesticides are registered for gypsy moth. Only a limited number are directly available for homeowner use. Several are available for commercial use only by a licensed tree arborist or lawn care specialist. Pesticides can significantly reduce defoliation, but there are a few things they will not do:

- Pesticides will not eliminate gypsy moth.
- They will not shorten the infestation period.
- If used improperly, they may delay a natural collapse of a population.

Pesticide Use and Safety

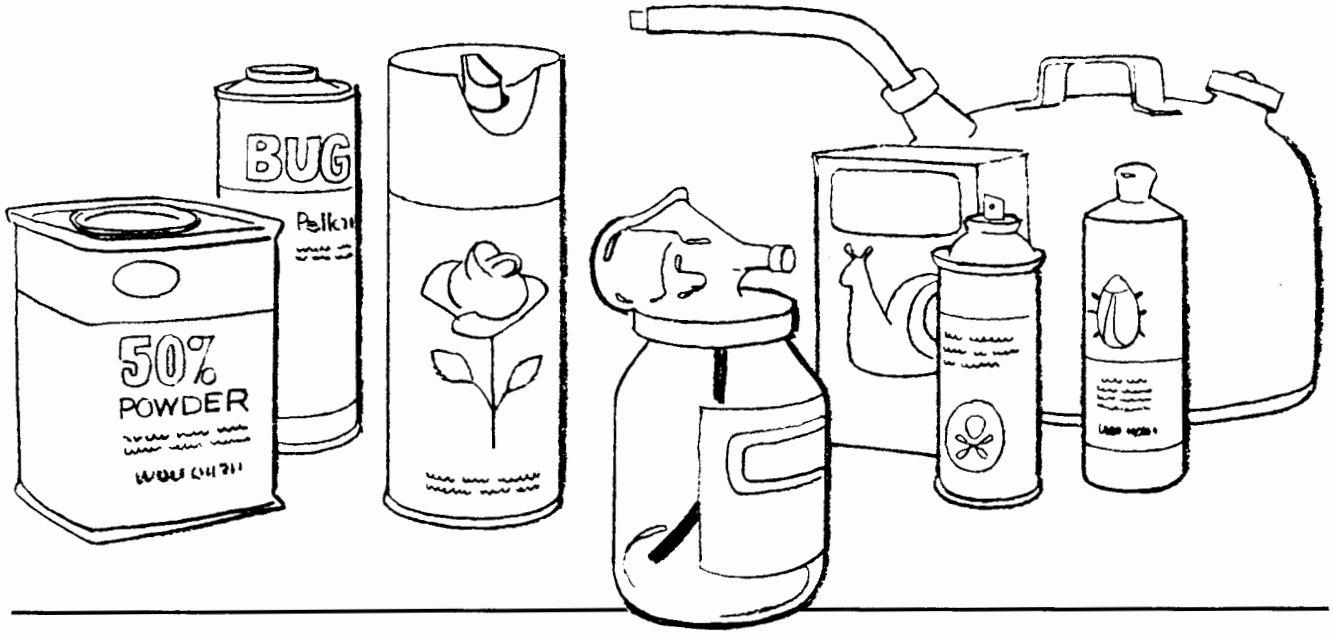
Correct timing and application are probably the most essential elements for success with pesticide applications. Homeowners must read and follow the label directions exactly! When used improperly, pesticides can pose more serious hazards to people, wildlife, and other environmental amenities than a truckload of gypsy moth caterpillars.

Questions to Ask a Professional

If you hire a lawn care specialist or tree arborist to spray your trees, take an active role in the decision making. Some questions you should ask are:

1. What pesticide will be used and why?
2. What precautions will be taken to prevent or lessen drift into neighbors' yards?
3. What are the specific environmental hazards of the pesticide?

*Watch the calendar.
To be most effective, pesticides should be used to treat caterpillars within a few weeks after hatching. Use the enclosed chart as a guide for selecting a pesticide.



Pesticide Chart

The pesticide chart inserted in the center of this pamphlet provides information on pesticides frequently used to suppress gypsy moth populations. Only five of these are directly available to a homeowner. Dimilin is not available for homeowner use because it has a restricted use label, but it is used most frequently in state suppression programs. Gypcheck, the pesticide developed by the U.S. Forest Service, contains the nucleopolyhydrosis virus. This naturally occurring virus is the major factor responsible for most natural population collapses. Scientists are developing a system which will allow the production of greater quantities of this product, eventually making it available for more widespread use.

The chart provides a ready reference for comparing the efficacy, toxicity, environmental hazard rating, and application methods of the pesticides. This chart should help you in planning a gypsy moth management scheme.

Remember, chemical pesticides will not provide a long-term solution. However, they can reduce defoliation and populations significantly enough to protect your trees during large gypsy moth outbreaks. Pesticides will not prevent gypsy moth populations from rebuilding in time.

The chart includes information under the following headings:

Product Name (Active Ingredient): The manufacturer's product name and the ingredient that acts to kill the caterpillars are given.

General Description: This provides some information about how the pesticide works. For example, some pesticides kill by contact with insects' outer cuticle. Those considered systemics must be consumed. The description also explains the type of chemical the pesticide is.

When and Where to Apply: These directions do not replace the label directions. They merely give some overall guidelines about using the pesticides.

Time Between Application & Noticeable Effect: This information gives you some idea of the time needed for the pesticide to have some noticeable effect. The actual time can vary because of many factors: density of population, timing of application, and overall environmental conditions. The times given are generalizations, but will allow you to compare the relative effectiveness of the various products.

Duration of Effectiveness: This is the approximate period that the product will remain active on the foliage.

Residual Life in Environment: This is the average total time that the product is expected to be present in the environment. Specific variables in the chemical state of the soil and water may raise or lower this average time.

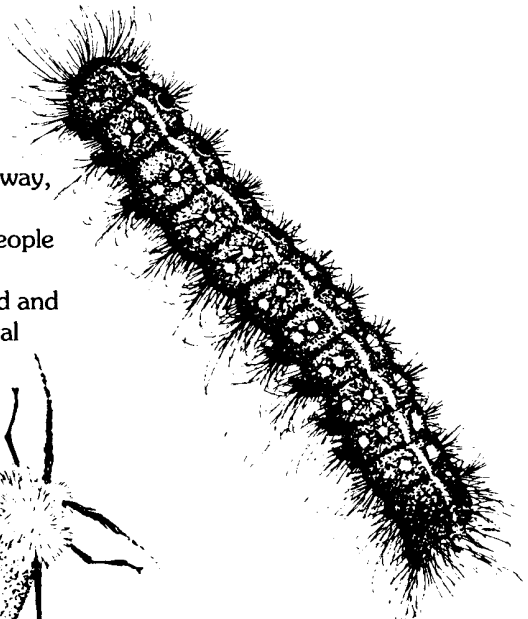
Environmental Hazards: The information refers to specific environmental hazards of the product at its application concentration.

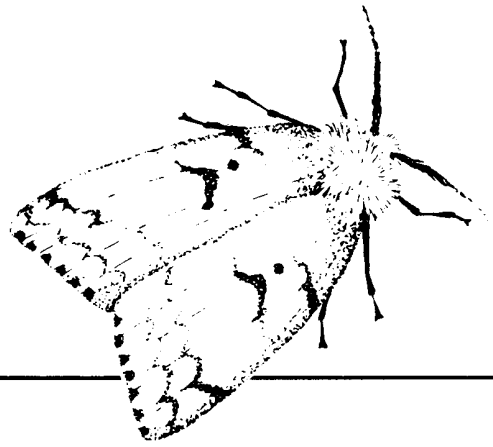
Toxicity: If contacted in some way, most chemical pesticides pose some level of harm either to people or wildlife. In terms of human health, pesticides are evaluated and rated for their toxicity in several ways. Most are evaluated and tested for any dermal, oral, and inhalation dangers. They are specifically tested for the dosage levels at which they become toxic. Some pesticides, for example, may be extremely toxic if ingested but only mildly toxic if inhaled. They also are tested for acute and chronic toxicity levels. Acute toxicity indicates an immediate effect, as opposed to a long-term cumulative one (chronic).

The acute toxicity value given on the pesticide chart is the oral LD50 for rats. This value corresponds to the quantity of the substance (the lethal dose) that killed more than 50% of the rats during the investigation. During the study rats received gradually increased doses to establish the LD50 rating. The LD50 value represents the milligrams of the substance consumed per kilogram of the subject's body weight.

LD50 VALUE

less than 50	=	highly toxic
50-499	=	Moderately toxic
500-5000	=	slightly toxic
more than 5000	=	relatively non-toxic



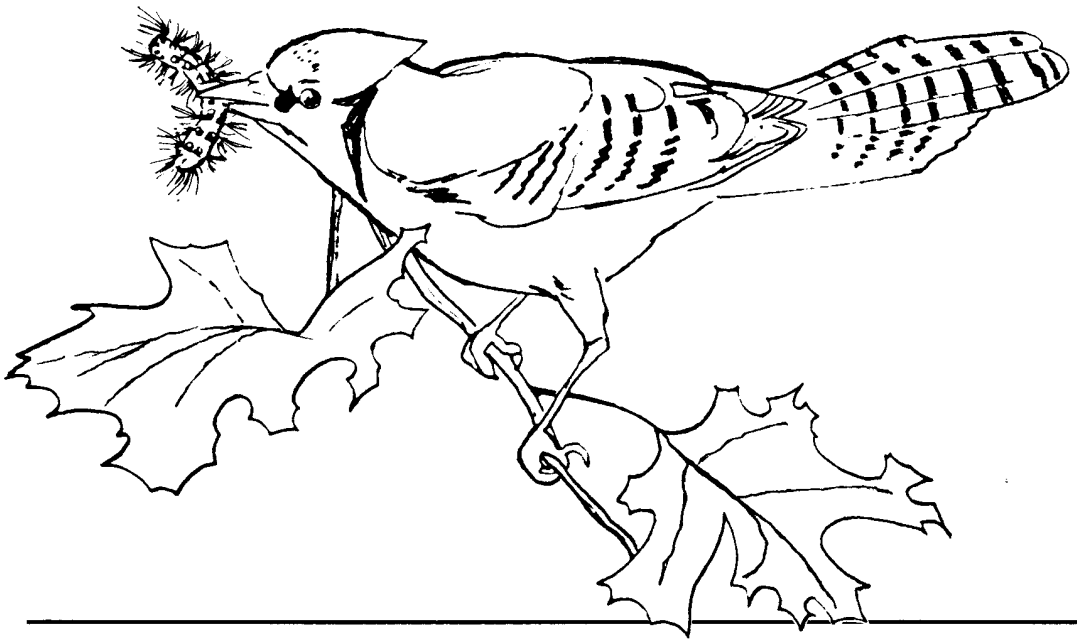


Biological Controls

Unfortunately, natural biological controls have a limited effect for individual homeowners. Natural biological controls will not prevent gypsy moth populations from escalating to outbreak proportions. The gypsy moth's ability to reproduce simply outpaces the total reproductive capacity of all its natural parasites and predators. Therefore, introducing parasitic wasps or predatory insects directly onto your property will not adequately protect your trees during outbreaks.

Biological controls do play a role in suppressing gypsy moth populations over a wide geographical region. Some studies have shown that parasitic wasps reduced gypsy moth populations by as much as 35%. Small mammals such as mice and shrews can consume several larvae. Other insects, especially certain species of ground beetles, may consume several larvae. A parasitic fungus, *Entomophaga maimaiga*, has caused the collapse of several populations of gypsy moth. Birds play a lesser role but will consume caterpillars. The sum total of potential predators and parasites over a wide geographical area can help. Consequently, encouraging the presence of natural control factors should not be completely ignored.

There are several biological pesticides containing the naturally occurring bacterium, *Bacillus thuringiensis (Bt)* as an active ingredient. They can be applied from the ground with a homemade mist blower. These pesticides are all fairly safe to use because they affect only species of moths and butterflies. However, timing is critical in reducing the population. *Bt* should be applied while caterpillars are still small. Two applications sometimes are needed to reduce the population adequately.



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Gypsy Moth Management Calendar

	January	February	March	April	May	June	July	August	September	October	November	December
Caterpillars Present *April 15 to July 15* Hatch may begin earlier Weather plays a role												
Pupae Present *June 1 - July*												
Adults Present *July - August*												
Egg Mass Present *Mass appears by July* Eggs remain on trees until spring hatch												
Place Sticky Bands on Trees *April 1 through June* Check daily and destroy any caterpillars found												
Apply Pesticides *April 15 - May 15* Most effective when applied to younger stages (instar 1-3).												
Place Burlap Bands *By May 1* Check daily through August. Destroy any life stages found.												
Cultural Tactics *March - October* See text page 7.												
Count Egg Masses *Anytime August through March*												
Destroy Egg Masses *Anytime August through March*												

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Pesticide Options for Gypsy Moth Management

Product Name (Active Ingredient)	General Description	Time to Apply	Time Between Application & Noticeable Effect	Duration of Effectiveness After Application	Environmental Considerations	Toxicity to Humans and Other Animals
Sevin (Carbaryl)	Carbamate pesticide. Stomach and contact poison. Broad-spectrum insecticide.	Whenever caterpillars are present. The earlier the better.	24 Hours	14-21 Days	Highly toxic to bees. Toxic to aquatic insects; moderately toxic to fish.	Slightly toxic (500-850 mg/kg)
Orthene (Acephate)	Organic phosphate. Primarily a stomach poison. Broad-spectrum insecticide.	Whenever caterpillars are present. The earlier the better.	12-24 Hours	6-9 Days	Toxic to bees. Can be toxic to birds.	Slightly toxic (1,494 mg/kg)
Ace Caps (Acephate)	Systemic implant, containing an organic phosphate. Stomach poison, broad-spectrum insecticide.	Just after caterpillars appear (April 1-15).	2-4 Days	12-18 Weeks	Will impact certain leaf-feeding insects throughout the growing season. Tree implants may injure trees.	Slightly toxic (945 mg/kg)
Bt (Bacillus thuringiensis) manufactured under many trade names	Biological insecticide. Stomach poison, naturally occurring bacteria.	Just after caterpillars appear (April 1-15). Must be used when capterpillars are very small.	2-4 Days	4-7 Days	Will impact certain other species of moths and butterflies.	Nontoxic to at the dosage applied.
*Dimilin (Diflubenzuron)	Insect growth regulator. Stomach poison with some contact effect.	Whenever caterpillars are present. The earlier the better.	2-7 Days	90+ Days on the leaves.	May be significant quantities on leaves at leaf fall. May significantly impact some aquatic arthropod chitin , as well as selected terrestrial leaf-feeding insect larvae.	Slightly toxic (4,640 mg/kg)
*Gypchek	Biological insecticide. Contains the naturally occurring, gypsy moth-specific nucleopolyhedrosis virus.	Just after caterpillars appear (April 1-15). Must be used when capterpillars are very small.	3 Days	3-5 Days	None; impacts gypsy moth caterpillars only.	Nontoxic at the dosage applied.

*Not available for homeowner use. Dimilin is a pesticide frequently used in the state suppression program. Gypchek is not produced commercially and is only available in limited quantities from the USDA Forest Service.

This document is provided for comparison purposes only and does not imply endorsement or recommendations of any of the products listed. Trade or brand names are mentioned only for information.
The West Virginia University Extension Service intends no endorsement nor implied discrimination to the exclusion of other products which may also be suitable.